

northeast or in the direction of the moving storm-cloud. At the town of Maitland, buildings were moved from their foundations and several unroofed. Clare, Clare Co., Mich., 22d, terrific hurricane during the night accompanied by violent thunder and lightning; great damage to property over a wide extent of country. In vicinity of Atwood's stations over 2,000,000 feet of timber was blown down; trees were "snapped off like pipe-stems" and the work of destruction was awful in its suddenness and completeness. Lansing, Ingham Co., Mich., 22d, very violent wind storm with terrific lightning, property destroyed to the value of \$25,000. Elmira, N. Y., 25th, gale lasted about 2 minutes, during which time it unroofed a large hotel, carried the roof of the Palace car shops over and several hundred feet beyond the adjoining freight building. Many houses were unroofed and windows blown out, church steeples thrown over and trees uprooted or broken off close to the ground. Rain fell in torrents, increasing the already serious loss of property. Owatonna, Minn., 29th, most destructive storm in the history of this region; about 100 small structures were more or less damaged; loss estimated at \$10,000. Wantoma, Wis., 29th., about 5 p. m. violent tornado passed near station from SSW. to NNE. through the countries of Washara and Waupaca. Preceding the storm, clouds in the western heavens looking like great sheets of white smoke, were dashed about in the wildest manner and finally combining in a long spout-like mass descended to the earth, over which it moved with great speed. Houses, barns and out-buildings in the path of the storm were completely torn to pieces; fences were strewn over the woods, corn fields swept clean, hay and grain stacks destroyed and the largest trees "snapped off like pipe-stems;" whole destruction consumed about 15 minutes. Width of storm path 80 rods, length 12 to 15 miles. In passing over Sandbar lake the storm formed a water-spout which carried up a great quantity of water and considerable fish upon the adjoining land. Stanton, Stanton Co., Nebr., 29th., about 9 p. m., tornado passed from SW. to NE., destroying a portion of the town; storm came up with a rushing, roaring noise like a heavy stock train and passed through the village with lightning rapidity, "it was gone in an instant." People were crazed by the sudden and awful awakening from slumber, and many were stripped of clothing, drenched with rain and severely injured by flying *debris*. Ten houses were completely leveled to the ground; path of storm about 300 yards wide. Emporia, Kans., 29th, 6.30 p. m., north and west of this city a terrible wind storm passed from WNW. to ESE. down the valley of the Neosho destroying an immense amount of farm property and killing 4 persons; 42 buildings were completely demolished and 10 to 15 more or less injured. Most destructive storm since the terrible tornado of 1878, and passed over about the same path as the tornado of June, 1881. Between Emporia and Howard the storm expended itself in an unusually heavy fall of rain accompanied by the most terrific display of lightning. At one place in the storm's path a flock of sheep valued at \$5,000 were all killed. Width of track from 3 to 100 rods; through the timber on Neosho river 30 rods. Lind, Wis., 29th, about 7 p. m., tornado, doing a vast amount of damage in town and country; in the former five buildings were completely blown to pieces and several others badly damaged. Centralia, Nemaha Co., Kans., 29th, about 6 p. m., violent wind storm five miles south of station; several buildings and much farm property destroyed.

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily indications for September, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 86.47 per cent. The percentages for the four elements are: Weather, 89.94; Direction of the Wind, 80.80; Temperature, 89.21; Barometer, 85.59 per cent. By geographical districts they are: For New England, 83.42; Middle Atlantic states, 87.61; South Atlantic states, 90.12; Eastern Gulf states, 91.08; Western Gulf states, 92.47; Lower Lake region, 84.98; Upper Lake region, 84.19; Tennessee and the Ohio valley, 86.57; Upper Mississippi valley, 83.87; Lower Missouri valley, 78.62; Northern Pacific coast region, 90.90; Central Pacific coast region, 100.00; Southern Pacific coast region, 100.00. There were 77 omissions to predict (47 being due to the absence of reports from the Pacific coast), out of 3,690, or 2.08 per cent. Of the 3,613 predictions that have been made, 111, or 3.07 per cent are considered to have entirely failed; 131, or 3.63 per cent. were one-fourth verified; 371, or 10.27 per cent. were one-half verified; 373, or 10.32 per cent. were three-fourths verified; 2,627, or 72.71 per cent. were fully verified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals.*—Seventy-seven Cautionary signals were displayed during the month, of which, 63, or 81.82 per cent. were fully justified by winds of twenty-five miles per hour or over, at or within a radius of 100 miles of the station. Two Off-shore signals were displayed, neither of which were fully justified; one was justified as to direction only, and the other failed with regard to both direction and velocity. Seventy-nine signals of both kinds were displayed, of which 63, or 79.75 per cent. were fully justified. The above does not include signals ordered at display stations where the velocity is only estimated. Seventy winds of twenty-five miles or over were reported for which no signals were ordered. Twenty signals were ordered late.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed at Signal Service stations during the month of

September, 1881. Throughout the month the principal rivers of the country have been extremely low, a remark which applies with equal if not greater force to the previous month of August. Comparing the highest readings of the gauge for the month of August, with those of September, it is found that the following changes have taken place during the latter month: Red River, +7 inches; Arkansas, -1 ft. 9 in.; Missouri, from -2 ft. 1 in. to -2 ft. 7 in.; Mississippi, -13 ft. 8 in. to +8 ft. 10 in.; Ohio, -1 in. to -3 in.; Cumberland, +9 in.; Tennessee, +3 ft. 2 in.; Monongahela, -1 in. to -1 ft. 3 in.; Savannah, +5 ft. 5 in.; Willamette, -4 ft. 6 in. to -5 ft.; Sacramento, +1 in. At but two stations did the water approach the danger line, viz.: Keokuk and Davenport.

**Floods.**—*Kansas*: Caldwell, 29th, heaviest rain for years, over 14 inches fell in 10 hours; trains delayed by serious washouts; creeks and rivers overflowed, causing great damage to bridges, fields and highways. Eureka, 29th, rainfall immense and almost unparalled; all streams overflowed; railroad and highway bridges damaged. Emporia, 29th, heaviest rainstorm ever seen in this section; streets flooded in half an hour, causing considerable damage to property. Sumner Co., 29th, in the southern portion, heaviest rain for several years; at Wilmington rain continued for seven consecutive hours, 7.45 inches falling in that time; creeks and sloughs overflowed submerging the bottom lands for miles; haystacks and corn crops damaged to a considerable extent. *Missouri*: Kansas City, 29th, 3 p. m., terrific storm of wind and rain, lasting about two hours; water filled the streets, which, in a short time, resembled small rivers. Basements were flooded, streets badly cut and embankments carried away. Railroad tracks covered with debris from falling walls and embankments, to such a degree as to prevent all travel for some time. Loss to private and city property about \$20,000. *Minnesota*: Spirit Lake, 16th, all railroad travel suspended by heavy washouts; very heavy rains for the past two days. St. Paul, 29th, all rivers and smaller streams flooded by the continued heavy rains; trains on the various railways delayed by washouts and land slides. At Minneapolis there was a jam of 20,000,000 feet of logs in the Mississippi, greatly endangering contiguous property. On the Minnesota the low lands were flooded on both sides of the river causing great loss to the hay crop. Marine, 29th, mill-dams carried away by the high water; bridges over Brown's creek and Fairy Hall creek washed out; low lands flooded. *Michigan*: Marquette, 29th, heavy washouts on railroads. Escanaba, 26th, streets badly washed and cellars flooded to depths of from 2 to 3 feet. *Nebraska*: Omaha, 29th, streets badly washed and basements flooded; high winds breaking down trees and scattering fences. *Texas*: San Antonio, 10th, streets flooded; creeks and rivers overflowed. *New York*: Elmira, 25th, rain fell so heavily that the sewers were unable to take the water off and immense damage was done to household goods by the water backing up and into the houses. *North Carolina*: Elsworth, much damage done the W. N. C., R. R., by the remarkably heavy rains of the 14th to 17th; several land slides on the mountain section and heavy washouts delayed all railroad communication until the 20th; monthly rainfall 26.50 inches. *Wisconsin*: Wausan, 29th, highest water ever known on the Wisconsin river, water rose at the rate of 4 inches an hour during the day; river 21 inches higher than the June flood of 1880; rainfall during 24 hours over 7 inches; 2,000,000 feet of logs washed away, together with a large quantity of lath and shingles; several houses washed away; all business suspended. La Crosse, 29th, all small streams flooded; in Coon valley the damage from high water is very heavy; all country bridges washed away; farmers have been unable to thresh and grain is sprouting in the stacks, which have been greatly damaged by water. Stewart, 29th, more water on the ground than at any time previous during the year; grain stacks nearly ruined by the continued driving rains.

**Drought.**—*Connecticut*: Southington, 30th, vegetation suffering severely; great scarcity of water. *Florida*: Houston, 30th, month very dry, all kinds of crops suffering for want of rain. *Indiana*: Vevay, 6th, Ohio river lower than ever known before. *Kentucky*: In central and eastern portions of state, 3rd, no rain in past 6 weeks. *Maryland*: Fallston, 30th, month remarkably dry, many crops have entirely failed, while all have suffered severely. Sandy Springs, 30th, vegetation suffering from an unprecedented drought. Woodstock, 30th, wells and springs very low, crops suffering. *Michigan*: Sanilac county, 17th, drought has been excessive and the effect upon crops very serious; the air is filled with dust and smoke, and all vegetation is parched. *New Jersey*: Trenton, 2nd, crops and cattle suffering from drought which extends the whole length and breadth of the state. In the northern part of Hudson, Co., where water supply is entirely derived from wells, the residents are compelled to haul water from Jersey City and Hoboken and pay as high as \$10.00 a load. The North Hudson R. R. Co., who have 600 horses at West Hoboken cart all their water in large iron tanks. From Burlington Co., it is reported that the Delaware and all the neighboring streams are unusually low; wells, cisterns and springs are nearly exhausted; corn crops and pastures are burning up; not even a vestige of green can be seen in many fields. Cape May, 4th, crops suffering severely; farmers report vegetables to be almost burned in the ground. Freehold, 30th, surrounding country very dry; crops below the average. *New York*: Buffalo, 2nd, very severe, farm products are very poor and short of the usual crop. Rochester, 2nd, grass and pastures are burned up and fruit is suffering severely; wells and streams dry; the surrounding country in great distress. McKean and Allegheny counties, 3rd, 1000 oil wells shut down for lack of water to run engines; no rain has fallen for

over a month. Albany, 3rd, unless rain soon falls it will be difficult to foretell the result of the terrible and unprecedented drought now prevailing. A drought so general and devastating has never been known in this country before. For miles about, the streams, wells and cisterns are dry and water is brought from distant places and sold by measure in various places; fruit is falling from the trees prematurely ripened and decayed; pastures are parched and there is no nutriment in grass of any kind; leaves are coloring and falling as in the fall; potatoes are being dug to prevent rot and other crops are withering or rotting in the fields; streams are lower than ever known before and navigation is seriously impeded; railroads find it difficult to run trains, owing to the lack of water for steam and in consequence there are daily, serious blockades of freight on the N. Y. Central R. R. Troy, 3rd, the numerous industries of the town suffering great inconvenience from lack of water; there is one-third falling off in the amount of work turned out in the linen and iron manufactories; all the streams run dry and several kinds of work suspended. In most instances people at the south end of the city are compelled to take water for domestic purposes from the almost stagnant ponds in the vicinity. Water very low in the Waterford level of the Champlain canal owing to the scarcity of water in the Mohawk river; boats frequently aground; lowest water for many years. Westchester Co., 29th, drought is paralyzing business, it is the most disastrous ever experienced; all vegetation is parched and nearly devoid of life; grass is brown and dead, trees are leafless and gardens and fields look like deserts; in some places the earth is as dry as powder to a depth of six feet and when a breeze passes over it, the air is like the current from a hot oven; cattle have become thin and sickly from lack of sufficient food; not a ton of corn-fodder has been raised in the county. The county is practically without water; wells and springs, never known to fail before, are now dry; the Bronx river has ceased to run; on the principal streams of the county, Byram, Cross, Saw-mill and Croton rivers, all business suspended; small creeks and brooks gave out several weeks since; cattle are driven 3 to 5 miles for water, and then only that which is stagnant can be obtained. Villages are especially suffering from drought; water is drawn from a distance in barrels and sold to the consumer. At White Plains, Mount Vernon, Pleasantville, Kensico, Scarsdale, Mount Kisco, Katonah, Croton Falls, Cheppaqua and other smaller villages, water is hauled from the neighboring rivers, which are now nearly dry. Croton Lake is very low and New York City is compelled to draw upon the storage reservoirs at Lake Mahopac and upon the upper reservoirs in Putnam county. Daysville, 19th, wells, cisterns and most of the streams entirely dry. Hannibal, 17th, the most terrible drought that ever visited this section; grass virtually dead; no food for stock except what has been stored for winter; wells and streams dry, people and animals suffering for water. *North Carolina*: Life-saving Station No. 6, 30th, the long continued drought has had a marked effect upon the sea-coast. The beach grass, affording an immense pasturage for thousands of cattle, has prematurely dried up, rendering the removal of the stock absolutely necessary before winter. Good drinking water cannot be obtained, that drawn from wells having a decided brackish taste. Corn and vegetation has generally failed. A serious type of sore throat has made its appearance, resulting fatally in nearly every instance; it is attributed to the extreme aridness of this section. The numerous creeks and ponds on the south side have stagnated, causing an unprecedented spread of malarious and climatic fevers. Kittyhawk, 30th, very severe during the month. Hatteras, 2d, great suffering for rain. *Ohio*: Leetonia, 10th, a most terrible drought still continues, the earth is baked and vegetation withered; no such weather ever experienced before. The sun appears like a large ball of fire suspended in the heavens, and the atmosphere is heated to a degree almost intolerable; schools have been closed until the 1st of October, and the rolling mills and tool works have suspended operations because of the excessive heat and unprecedented lack of water. Columbus, 9th, the extreme drought causes great suffering; city enveloped in smoke. *Pennsylvania*: Catawissa, 30th, owing to long continued drought trees are generally dying; pastures destroyed and farmers are feeding their cattle with hay; fall seeding delayed; the earth is like an ash heap to a depth of 4 feet; the North Branch of the Susquehanna is five inches lower than the lowest point ever before recorded; small brooks that have never failed are now dry. Fallsington, 30th, wells, springs and small streams are generally dry; farmers have not put in their fall wheat owing to the baked condition of the soil. In the northwestern portion of the state, which is principally a dairy country, the loss to crops and dairy interests can hardly be estimated; corn will yield about half a crop, grapes about one-third and other small fruits are drying up or rotting on the trees. Erie, 5th, stock suffering severely; crops seriously damaged; many small streams entirely dry. *Tennessee*: Chattanooga, 12th, river lower than at any time since 1839; crops seriously damaged. 13th, river reached zero point on gauge corresponding with the low water mark of 1839, which is the lowest ever known at this point. Memphis, 30th, correspondence of the cotton exchange in this and neighboring States report very unfavorable prospects for the cotton crop owing to the severe drought. *Virginia*: Fredericksburg, 2nd, precedent in the history of northern Virginia; in some places rain has not fallen for three months; there is no food for cattle, and in some cases people have traveled 30 miles for feed. On the upper Rappahannock water is hauled long distances for household uses. Ft. Myer, 10th, crops in surrounding country, greatly injured from drought.

*Water Spouts.*—Key West, 10th, 1.20 p. m., two water spouts were seen 7 miles WNW. from station, moving from E. to W.; one was complete, extending from a cumulo-stratus cloud to the water; the other was from the same cloud, but was only partially formed; it descended from the cloud but did not connect with the water; the phenomenon lasted for 25 minutes. Hatteras, N. C., 4th, 12 m., a large water spout was observed in the sound, about 3 miles north of station. When first observed, it was fully formed and extended from a heavy cumulo-stratus cloud, of black appearance, to the water, apparently a distance of half a mile. The spout was of a light grayish color near the water and of much darker color near the cloud; the water at its base seemed much agitated and was raised to a height of from 3 to 4 feet for several rods around. The water could be distinctly seen ascending the spout rapidly, with a spirally upward motion. The spout lasted for five minutes, when it broke; ten minutes elapsed before the column was fully drawn up and had disappeared within the cloud.

*High Tides.*—Indianola, 28th, 29th, 30th; Portsmouth, N. C., 3d, 13th; New Haven, 9th, 10th.

## TEMPERATURE OF WATER.

*The Temperature of Water*, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left-hand side of chart No. III. Owing to loss of instrument, observations at Charleston are wanting on the 9th, and from the 24th to the 30th.

## ATMOSPHERIC ELECTRICITY.

*Thunder-storms.*—In the various districts they were reported as follows: New England, 1st to 7th, 11th, 13th, 22nd to 24th, 26th to 29th; Middle Atlantic states, 1st to 3rd, 5th, 9th to 12th, 22nd, 23rd, 25th to 29th; South Atlantic states, 3rd, 4th, 7th, 9th, 11th, 12th, 13th, 17th, 26th, 27th; Eastern Gulf states, 8th, 10th to 19th, 26th to 28th; Florida Peninsula, 1st to 7th, 10th to 16th, 19th, 21st, 22nd to 27th, 30th; Western Gulf states, 1st, 6th to 10th, 12th, 13th, 27th, 29th, 30th; Rio Grande valley, 1st, 6th, 7th, 8th, 10th, 11th, 13th, 27th, 29th, 30th; Ohio valley and Tennessee, 1st to 4th, 8th to 11th, 13th, 14th, 18th, 19th, 21st, 23rd to 28th, Lower Lake region, 1st to 5th, 9th, 10th, 12th, 22nd to 27th; Upper Lake region, 1st to 6th, 8th to 10th, 14th to 18th, 21st to 30th; Upper Mississippi valley, 1st to 12th, 14th, 15th, 21st to 30th; Missouri valley, 1st to 6th, 9th to 15th, 19th, 22nd to 30th; extreme Northwest, 3rd, 4th, 9th, 11th, 13th, 19th, 20th, 24th; Northern Slope, 1st to 4th, 18th, 19th, 21st to 23rd, 28th, 29th; Middle Slope, 1st, 5th, 6th, 9th, 18th, 22nd, 23rd, 25th, 26th to 29th; Southern Slope, 5th, 6th, 12th, 26th to 29th; Southern Plateau, 3rd, 4th, 10th to 13th, 28th; Middle Plateau, 23rd; Northern Plateau, 2nd, 4th, 8th, 13th, 17th, 24th; North Pacific coast region, 4th, 8th, 17th, 22nd, 23rd; Middle Pacific coast region, 1st, 2nd, 21st to 27th.

*Atmospheric Electricity Interfering with Telegraphic Communication.*—Dodge City, Kan., 29th; Ft. Elliott, Tex., 28th; Jacksboro, Tex., 7th, 27th and 29th; Eagle Pass, Tex., 8th and 29th; Brackettville, Tex., 30th; Bismarck, Dak., 19th.

*Zodiacal Light.*—Nashville, 5th, 6th, 11th, 12th, 16th, 17th, 19th to 25th and 30th; Wood's Holl, Mass., 15th and 16th; New Corydon, Ind., 21st, 22d, 24th, 26th, 27th and 30th; Monticello, Ia., 1st.

*Auroras.*—The most remarkable display for several years occurred on the 12th, 13th and 14th, and the line of observation was continuous from Sydney, N. S., westward to Umatilla, Or. Observers reported its appearance as far south as Louisville and northward to St. Vincent, Minn. At several stations in Dakota and Minnesota the display began on the 11th, and probably on this date the districts eastward to the Atlantic would have reported the same phenomenon had it not been for the heavy cloudiness which prevailed from the Lake region eastward to Newfoundland, accompanying the progress of low area No. II. It is interesting to note in connection with this great electrical disturbance that on precisely the same dates, but during the previous month of August a remarkable auroral display was observed very extensively in England and Scotland. An observer at the Stonyhurst Observatory describes it as recalling the magnificent displays of 1869, 1870 and 1872, while the play of the magnets was one of the most violent ever recorded at that observatory. On the 11th, 12th and 13th of August observers of the sun found indications of intense commotion; sunspots were numerous, large and active and protuberances shot up from the sun's surface, with increased force and velocity. The earth appeared to make instantaneous response to the solar storm and a magnetic disturbance suddenly commenced by an unusual exhibition of earth currents. At the Greenwich Observatory no such magnetic disturbance had been recorded for many years. This auroral display was not only very extensive but exceedingly brilliant, and many of its manifestations wonderfully strange; in the United States but two stations reported, viz: Duluth, 13th, 11 p. m.; St. Vincent, 12th, 10 p. m. Concerning the display for the present month (September) the following stations, with few exceptions, report the time of appearance and disappearance: Sydney, C. B. I., 14th. Halifax, N. S., 13th, 14th. Eastport, Me., 12th, from 8 to 11 p. m.; 13th, from 8 to 10 p. m.; 14th, from 7 to 9 p. m. Bangor, Me., 12th, from early dusk until midnight. Cornish Me., 14th. Dexter, Me., 12th, 7 to 9 p. m.; 14th, 8 to 10 p. m. Mt. Washington, N. H., 12th, 7 to 10.20 p. m.; 13th, 1.10 to 4 a. m., and from 7 to 8.40 p. m. Burlington, Vt., 12th, 7.15 to 9 p. m.; 14th, 8.30 to 10.30 p. m. Newport, Vt., 12th, 8 to 9 p. m.